have been solved and those being studied now, the techniques which have been used and those showing the greatest promise at present. The speakers could hardly have been better chosen for this task, and there was, as a result, general agreement on the great success of the symposium.

In the introductory lecture on Monday morning, W. Cochran, organizer of the symposium, gave us a little of the history of the subject, an elementary account of the theory, and a summary of the several techniques which have been used for measurements of thermal vibrations. In the second lecture, B. E. Warren showed how dispersion curves for elastic waves can be obtained from the intensity of thermal scattering of x rays. He then described the use of lattice theory to obtain from the dispersion curves a set of interatomic force constants from which the frequency distribution of the crystal may be obtained.

B. N. Brockhouse, in discussing the role of neutron inelastic-scattering measurements in determining the thermal motion of a crystal, pointed out that the great advantage of neutron measurements is that both the energy and momentum changes of the neutron caused by the scattering can be measured, giving directly the dispersion curves. He then showed experimental dispersion curves obtained with neutrons and discussed the different models of interatomic forces needed to explain the results.

In the afternoon, J. P. Mathieu discussed the optical aspects of lattice vibrations. He described the diffusion of visible and ultraviolet light by elastic waves, the absorption of infrared radiation, and the determination of optical constants from these measurements.

W. Ludwig ended the symposium on a theoretical note, reviewing the many difficulties encountered in calculating the lattice dynamics of a crystal so essential to an understanding of thermal motions. He concluded by discussing the very current problem of handling anharmonic terms in the equations of motion and the effects of anharmonicity on measureable properties of the crystal.

AUTOMATION

a session of the Commission on Crystallographic Apparatus

By ***S. C. Abrahams***

For most crystallographers, the twin problems of how to measure integrated intensities accurately and how to measure them quickly are of daily concern. An open session of the IUCr Commission on Crystallographic Apparatus, called specifically to discuss these problems, provided a high point of the Sixth Congress. This session contained six invited papers, followed by a vigorous informal discussion held with less rigid attention to time than most other sessions.

U. W. Arndt of the Medical Research Council, Cambridge, gave a comprehensive review of basic designs in automatic analog and digital single-crystal diffractometers. S. C. Abrahams, of Bell Telephone Laboratories, Murray Hill, N. J., drew attention to many important sources of error in diffractometer measurement. Criteria were given for their detection with typical examples based on one fully automatic diffractometer. L. E. Alexander of the Mellon Institute, Pittsburgh, discussed the different experimental geometries used in making integrated intensity measurements, with particular reference to the spectral composition of the diffracted beam.

Turning specifically to neutron diffractometry, H. A. Levy of the Oak Ridge National Laboratory compared existing automatic systems and then gave an impressive demonstration of the reliability and accuracy of the new ORNL diffractometer.

Descriptions of the four automatic single-crystal diffractometers in Japan were given by S. Hoshino of Tokyo University. G. Gaglioki of C. C. R. Euratom, Ispra, then discussed some of the problems in measuring the integrated intensity of diffracted neutron beams.

An 18-minute film entitled "Automated X-Ray Diffractometry"* opened the lively informal discussion. It was generally regarded as unfortunate that the basic session on important new apparatus was scheduled to conflict with simultaneous sessions on proteins and on crystal morphology in the morning, and on six other topics in the afternoon.

* Prints of this movie are available, on request, from S. C. Abrahams, Bell Telephone Laboratories, Murray Hill, N.J.